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Assortative Mating in Man*

WHEN THE THEORETICAL foundations of population genetics were worked out in the beginning of this century, hardly any empirical examples of Hardy-Weinberg equilibrium situations were known in man. During the last decades, however, a large number of polymorphisms have been detected. These marker systems, which are almost exclusively confined to biochemical-physiological traits have provided empirical verifications of the existence of Hardy-Weinberg equilibria and random mating in human populations. On the basis of the information collected the view has generally been developed that although slight deviations from panmixia certainly exist in human populations, they are probably of such a low degree that they should not give rise to any detectable rearrangements of the genotype distributions. However, we still have very little knowledge about the occurrence of deviations from random mating in man.

The Historical Background

When analysing the family records compiled by Sir Francis Galton, Pearson found a correlation with respect to stature between marriage partners, which encouraged him to undertake the well-known classical study of assortative mating for stature, span and forearm in 1903.[14] The correlation coefficients were of a magnitude of about 0·2, the highest being found for stature. In another paper Pearson (anonymously, 1902) discussed the principal effect of assortative mating compared to inbreeding and also gave evidence for the existence of assortative mating for a character such as length of life.

Since these first studies very few workers have been interested in collecting empirical data showing the existence and magnitude of assortative mating. This fact has been pointed out by Dahlberg.[3,4] The theoretical implications of assortative mating have, however, attracted several investigators including Wright in 1921 and Dahlberg in 1947.

During the last few years a new interest in problems concerning assortative mating is discernible. Thus, Darlington[5,6] has stressed the importance of assortative mating with respect to fertility. We, at the Institute for Medical Genetics in Uppsala, have taken up studies of assortative mating of which some results will be presented in this communication.

It may be convenient for several reasons to treat separately assortative mating for physical, mental and demographical traits.

Assortative Mating and Physical Traits

In Table 1 the data obtained by Pearson and Lee[14] in 1903 are compared with some results from other investigations.

TABLE 1

CORRELATIONS BETWEEN WIVES AND HUSBANDS FOR SOME ANTHROPOMETRIC TRAITS

Pearson and Lee (1903)	Stature	0·2804 ± 0·0189
	Span	0·1989 ± 0·0204
	Forearm	0·1977 ± 0·0205
Elston (1961[a])	Stature	0·215 ± 0·068
	Cephalic index	0·217 ± 0·059
	Face index	0·197 ± 0·060
Furusho (1961)	Stature	0·072 ± 0·057

After an analysis of cross assortative mating Pearson concluded that there was evidence that not only direct selection for these three characters had taken place, but that the similarity between wife and husband concerning span and forearm was not solely dependent on a selection of stature.

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It is interesting to compare these figures with some data from the Swedish Lapps presented by Elston in 1961.[7] For three different anthropometric traits much the same correlation coefficients were found. The nomadic Swedish Lapps constitute a rather small, fairly homogeneous group with little admixture of other race groups. They have a low mean stature and the cephalic index is considerably higher than in Swedes.[2]

There is no great difference between the three traits with respect to the correlation coefficients. One would have expected to find a much more pronounced association for a trait like stature than for cephalic index. It is very unlikely that such slight differences of head shape as those here concerned, may be perceived and used as a basis for the selection of the marriage partner. It seems more probable that selection has taken place according to Lappish race type as a whole, so that more typical Lapps mate more often than chance would indicate.

Not all studies of assortative mating for stature have given statistically significant results. Table 1 also includes data by Furusho (1961),[9] who found no conclusive evidence for assortative mating in a study from Japan.

For eye-colour Pearson and Lee[14] reported a correlation between wives and husbands of $0{\cdot}10 \pm 0{\cdot}04$. In a sample from Uppsala Elston[7] also found evidence for assortative mating according to eye-colour (Table 2). The individuals were classified by means of the Martin-Saller eye-colour scale and on this scale dark eyes correspond to No. 2-8. The figures seem to leave no room for doubting the existence of assortative mating with respect to eye-colour.

TABLE 2

CORRELATION BETWEEN WIVES AND HUSBANDS IN RESPECT TO EYE-COLOUR (ELSTON 1961[a]). (Expected figures within brackets)

	HUSBAND		
WIFE	Dark eyes	Blue eyes	Total
Dark eyes	92 (73)	117 (136)	209
Blue eyes	77 (96)	197 (178)	274
Total	169	314	483

Dark eyes = No. 2–8 on the eye-colour scale by Martin-Saller.
$\chi^2 = 13{\cdot}39$, 1 d.f. $P < 0{\cdot}001$

When analysing the occurrence of assortivate mating for eye-colour in a sample of Swedish Lapps, I found no evidence for a correlation between wives and husbands (Table 3). In this study which was based on the primary data published by Dahlberg and Wahlund[2] in 1941, the classifications were also made by means of a fixed scale (Martin). In the Lapps a large number of individuals have brown eyes and very few have clearly blue eyes. The lack of a correlation for eye-colour may in part depend on the fact that most of the individuals in the category of light or mixed eyes actually have rather dark eyes and thus that the variability in respect to eye-colour is less than in the sample of Swedes, which makes discrimination according to eye-colour less efficient in the Lappish group.

TABLE 3

CORRELATION BETWEEN WIVES AND HUSBANDS IN RESPECT TO EYE-COLOUR (SWEDISH LAPPS). (Expected figures within brackets)

	HUSBAND		
WIFE	Brown eyes	Light or mixed eyes	Total
Brown eyes	23 (23)	36 (36)	59
Light or mixed eyes	81 (81)	126 (126)	207
Total	104	162	266

Brown eyes = No. 11-16 on the eye-colour scale by Martin.

The low degree of correlation for eye-colour in the Lapps is, however, still rather surprising in view of the strong association for hair colour found between mates in the same material (Table 4).

TABLE 4

CORRELATION BETWEEN WIVES AND HUSBANDS IN RESPECT TO HAIR-COLOUR (SWEDISH LAPPS) (Expected figures within brackets)

	HUSBAND		
WIFE	Dark hair	Light hair	Total
Dark hair	68 (51)	49 (66)	117
Light hair	37 (54)	87 (70)	124
Total	105	136	241

Dark hair = No. 4-6, 27-28 on the hair-colour scale by Fischer.
$\chi^2 = 19{\cdot}96$, 1 d.f., $P < 0{\cdot}001$

Assortative Mating and Mental Traits

We can also expect to find evidence for assortative mating for different mental characters. Thus with respect to mental capacity there must be a rather strong correlation between mates. Dahlberg wrote in 1947: "We can suspect musical persons of marrying one another particularly often, and, generally, expect hereditary characters of importance for special interests to make for a certain degree of assortative mating; interests unite people."

Elston in his study of assortative mating in a sample from Uppsala also included different mental traits. He has kindly supplied some unpublished data[8] relating to correlation for musicality between wives and husbands (Table 5). The individuals were classified into two

TABLE 5

CORRELATION BETWEEN WIVES AND HUSBANDS IN RESPECT TO MUSICAL INTEREST (ELSTON 1961[b])
(Expected figures within brackets)

	HUSBAND		
WIFE	Musical	Non-musical	Total
Musical	75 (46·6)	78 (106·4)	153
Non-musical	73 (101·4)	260 (231·6)	333
Total	148	338	486

$x^2 = 36{\cdot}32$, 1 d.f. $P < 0{\cdot}001$

groups; those who had manifested musical interest by playing an instrument (before marriage) and those who had not. The former group was operationally termed musical and the latter non-musical.

There is a very strong association between married individuals concerning "musical interest." Someone may find it astonishing that as much as about 30 per cent of the individuals were able to play an instrument. This surely depends on the fact that Uppsala is a rather small town, that to a large extent is dominated by the university and thus that a fairly large proportion of the individuals have a high degree of education.

As "musical interest" and ability to play an instrument certainly may be correlated with educational group and social group, it is evident that the classification used above does not show the potential musicality of the individuals. It is also possible that the correlation found is a "secondary" one depending on assortative mating for educational group. This question will be elucidated in a forthcoming study.

Assortative Mating and Demographic Traits

Perhaps the most interesting aspects of assortative mating are those concerning demographic traits, such as length of life, fertility and mobility. As long ago as 1903 Pearson made a study of correlation between husband and wife in respect to length of life. Data were collected from two fairly limited rural districts (Wensleydale and adjacent dales and the villages round Oxford) and one limited class (the Society of Friends). In all three cases a correlation coefficient of about 0·2 was obtained with a mean of 0·2233. After having discussed the possible influence by local or class variations and environmental factors Pearson concluded: "We are thus forced to conclude that the correlation actually observed between the length of life in two married persons is a measure of a real tendency towards homogamy, comparable with other cases of assortative mating."

Darlington[5,6] has pointed out the importance of assortative mating for fertility. He studied the offspring of individuals who had been married both to a cousin and to an unrelated individual. These "double-marriage" families were also classified into outbred and inbred families, according to the occurrence of consanguineous marriages in the previous generations. When analysing the variations in the numbers of children, grandchildren and great-grandchildren in these families Darlington found that inbreeders suffer by outbreeding and outbreeders by inbreeding. A decrease of fecundity was found not only in the first generation, but also in the second and third generations. Darlington stated that this phenomenon could only be explained as an effect of assortative mating for fertility "individuals with low fertility marry spouses with low fertility."

It is reasonable to assume that low fertility to a large extent depends on the integrated effect of a number of lethal genes or genes decreasing the general vitality. Thus, if assortative mating according to fertility exists in human populations it would mean a selection against a large number

of deleterious genes, for, as Darlington points out, the effect of assortative mating for fertility in consecutive generations is cumulative and hence some families may become extinct in a few generations.

Darlington's statements were based on the results from the "double-marriage" families only, and no data showing the correlation between mates concerning familial fecundity were presented.

Beckman and Elston[1] have studied the correlation between wife and husband in respect to familial fecundity as measured by the number of sibs. The individuals were classified into two groups: those who had less than four sibs and those who had four or more. Table 6 seems to

TABLE 6

CORRELATION BETWEEN WIVES AND HUSBANDS IN RESPECT TO NUMBER OF SIBS (BECKMAN AND ELSTON 1962)
(Expected figures within brackets)

WIFE	HUSBAND 0-3 sibs	More than 4 sibs	Total
0-3 sibs	173 (150·9)	105 (127·1)	278
More than 4 sibs	86 (108·1)	113 (90·9)	199
Total	259	218	477

$\chi^2 = 16{\cdot}97$, 1 d.f. $P < 0{\cdot}001$

show that there is rather strong evidence for the occurrence of positive assortative mating for sibship size. When the total material was subdivided according to the year of birth of the individuals, however, it became evident that the correlation between mates concerning sibship size is most likely a "secondary" phenomenon (Table 7). The average number of children has

TABLE 7

CORRELATIONS BETWEEN WIVES AND HUSBANDS IN RESPECT TO NUMBER OF SIBS WHEN THE PARTNERS ARE GROUPED ACCORDING TO YEAR OF BIRTH

	χ^2 1 d.f.	P	No.
1. Both partners born before 1900	2·73	$0{\cdot}1 > P > 0{\cdot}05$	75
2. Both partners born 1900-1919	0·48	$0{\cdot}5 > P > 0{\cdot}3$	144
3. Both partners born after 1920	2·42	$0{\cdot}2 > P > 0{\cdot}1$	192
4. Partners of unlike birth periods	10·38	$0{\cdot}005 > P > 0{\cdot}001$	68
Sum of 1-3	9·87	$0{\cdot}005 > P > 0{\cdot}001$	409
Sum of 1-4	16·87	$P > 0{\cdot}001$	477

decreased markedly during the last century. Thus older individuals in this sample have on the average more sibs than the younger ones. The very strong assortative mating for age has then created the results observed and thus we may not conclude that there exists any sort of selective process (conscious or unconscious) in respect to the number of sibs of a prospective marriage partner. Assortative mating for social groups may also create similar "false" correlations since it is a well-known fact that the average number of children differs between social groups. Most investigators have discussed sources of bias due to local or class variations, while the variations by time have mostly been forgotten. As Beckman and Elston[1] have pointed out, the time trend in respect to average length of life may explain the correlations found by Pearson in 1903 for length of life between wives and husbands, for the data were collected over a long period of time. (Tombstone records were used.) When selecting a very small geographical area to exclude the influence of local variations, it was naturally impossible to find a sufficient number of married couples from a limited period of time.

We may thus conclude that in studies of assortative mating for demographic traits one is likely to obtain positive results simply because of the time trend existing for most of these characteristics. Most correlation coefficients have a curious tendency to fall close to 0·2, which is not to be expected since the intensity of selection should be different for various traits. I do not mean to say that a coefficient of 0·2 is what the time trend would give, but it is certainly operating behind many figures. We must then recall that the average stature in Sweden has increased by about 10 centimetres during the last century and thus when collecting data on married couples of different ages we may face the same source of bias as that for number of sibs, which may exaggerate the results. A correlation for stature then automatically gives a correlation for most anthropometric traits.

In my opinion great care has to be exercised when interpreting data on assortative mating especially those concerning demographic and anthropometric traits. Pigmentation characters (hair and eye-colour) are probably less biased, but here also variations between social groups

are known (cf. Lundborg and Linders, 1926).[12]

Assortative Mating and Racial Prejudice

It is almost certain that there exists a conscious or unconscious process of assortative mating for pigmentation characters such as hair and eye-colour even in such a homogeneous population as the Swedish one. It is reasonable to assume that this process of sexual discrimination is more effective in a highly heterogeneous population such as a mixed negro-white community. It is not possible, of course, to estimate what proportion of the race discrimination based on pigmentation traits depends on prejudice and on unconscious assortative mating. All that can be said is that even if we could eliminate all kinds of race prejudice by education, there would probably still exist a discrimination process based on pigmentation traits. Such a process would not *per se* mean anything undesirable and would not cause any social tension as long as the choice of marriage partner is dependent only on the free will of the individuals involved, without any interference of social pressures.

Gregor,[11] discussing the nature of prejudice, states that "Prejudice is the obverse image of preferential association." During the XIXth International Congress of Sociology in Mexico City in 1960 controversial opinions were expressed during discussion of the causes of race discrimination. In a review of these discussions Gregor[10] stated that man shares with the social animals a native disposition to preferred association and that the racial differences act as a focal point for group orientation. Some of the members of this conference seemed to be in favour of the theory of inborn racial attitudes and some were against it. It is interesting to note that, in recent discussions of assortative mating, questions of race discrimination were often involved. It seems as if there is a tendency to "excuse" race discrimination by explaining it as an exaggeration of the processes of assortative mating occurring *within* races and by stating that the tendency to positive assortative mating is an inborn phenomenon in humans. In a new journal *The Mankind Quarterly*, which has been developed to provide a forum for criticism of the UNESCO Statement on Race, such views have often been expressed by different authors. Without taking up any definite position in this question, about which we know too little at present, I should like to close this lecture with the statement that studies of assortative mating in man are certainly of much greater importance for the understanding of the breeding patterns of human populations than the actual interest of scientists in these problems might indicate.

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